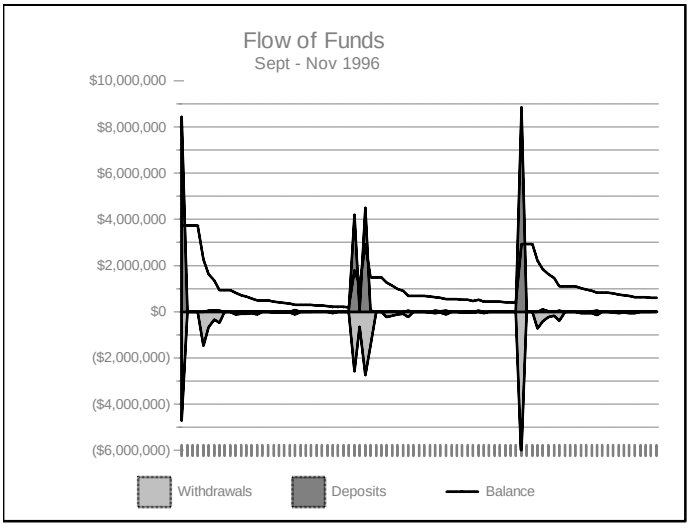
Float Earnings Valuation

The growth of electronic benefit transfer (EBT) practices to deliver government payments to those populations least susceptible to electronic funds transfer invites review of what has been learned in the tests and pilots conducted. Much information is available from the Direct Payment Card (DPC) test performed in Texas. This note uses some of those data to examine one critical aspect: the potential for the undrawn balances in the EBT accounts to generate earnings for the serving financial institution.

Data were recorded in a special study performed by Citibank for ninety days from the end of August to late November 1996. The financial institution recorded the total deposits, withdrawals made through the Pulse and Cirrus networks, and the undrawn balance, brought forward, for all accounts. This is very summary information. It is not possible to trace the activity in any one account or under any individual program (e.g. SSI) with this information. It is, however, a statement of the total program funds which are idle and available for the financial institution's use. The balance information was used to calculate the interest earnings that could be gained from idle EBT funds.



Complete, specific data are given in Appendix 1 but they can be summarized in the graph at right. This chart shows the inflow, outflow and remaining balance in all accounts in the DPC program for a three month period. The start of each month can be identified by the large spikes in the graph. Deposits are shown as positive amounts; withdrawals, as negative ones; and the remaining balance, as the varying line in the positive region. The graph also highlights behavioral patterns in the flow of funds. In particular, most funds are deposited on one or two days a month.[1] Over half of those new funds is immediately withdrawn. The second week

[1]The DPC test delivers funds under several benefit programs. Most participants receive funds under SSI, which is paid on the first of the month, or SSA, which is paid on the third. The October payments following this pattern is marked by two deposit spikes, one for each program, at the start of the month. When the usual payment day falls on a weekend or a holiday, the benefits are paid on the last business day before that date. This occurred in September and November. Both programs were paid on the same day and the start of the month is marked with

of the month then shows the next largest outflow although one that is much smaller than the first week's. The balance is steadily eroded by constant withdrawals through the month.

Imputed Interest Earnings on Undrawn Balances

To calculate the amount (
EBT balances, the daily balance (
as a daily rate. That is,

$$t \quad t \left(\frac{\quad}{365}\right)$$

is the amount earned on day t.

The total might then be expressed relative to some other factor to better demonstrate its scale. For example, the monthly earnings per account might be useful in assessing the extent to which such earnings might be used to offset monthly account management fees. This is calculated by summing the $_t$ for all t in the month and dividing the sum by 21,700, the approximate number of accounts in the pilot. *Using the data cited above, and choosing*
estimate of $0.19 per account per month as the expected earnings the financial institution may see from idle EBT balances attributable to benefit payments made during the three months .
(The daily amounts used in this calculation are presented in Appendix 2.)

The amount may be also scaled relative to the total amount of funds involved or other measures useful for predicting the amounts that might be expected from further extensions of the EBT program.

Selection of an appropriate value for
attributable to any idle balance will vary directly with the rate chosen. There are three factors to consider: the market sector, the term, and the time period. The first of these refers to the fact that at any given time different industries and classes of borrowers will confront different prevailing market interest rates depending upon the lender-perceived riskiness of the borrower. The rate for U.S. Treasury borrowing will be used in this note. This is done with the knowledge that because it is historically lower than any other rates it will present a lower estimate of the potential earnings the *financial institution* might obtain. It is chosen instead to show what opportunity cost is imposed upon the Treasury by the indifferent forces of behavior and business patterns. Further, the Treasury rate provides a common measure for comparing EBT float costs against the float costs of any other payment mechanism used by the government. There is no obvious alternative

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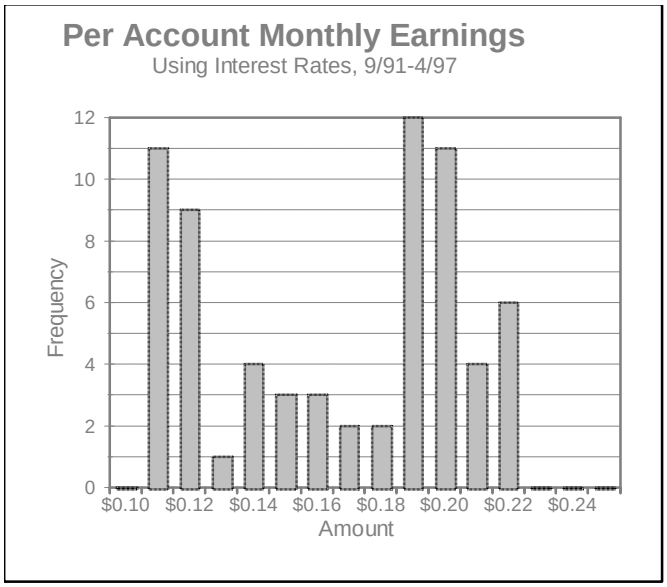
one large deposit spike.

to a Treasury rate: any proposal for the actual rate of return the financial institution might earn on its funds would be highly speculative.



The standard of comparability recommends use of the thirteen week Treasury bill rate for this analysis. The monthly average value of this rate is used to impute the value to financial institutions of compensating balances placed with them for collection services. Because it is the cost of short term borrowing needs, it is a good measure of the cash management costs of idle funds to the Treasury. During the period for which the balance data were collected, the rate was near five percent. Thus the second and third considerations in choosing a value of addressed.

Sensitivity of Estimate

The analysis given here presents an estimate of a financial institution's potential earnings from undrawn EBT balances. As an estimate, the value given is one point within a range of possible outcomes. The specific value observed may be influenced by many factors. Any variation in the time period used for the analysis will affect the calculated average idle balances and hence the earnings estimate. There may be behavioral patterns that vary with seasons which could also lead to slightly different values if the study were performed at another time of year.

To the extent that the primary behavior exhibited in the account balances observed is generally representative, however, it is possible to establish bounds of reasonableness for the estimate of per account monthly earnings. The earnings credit rate (and the underlying thirteen week Treasury bill rate) has varied over the past six years from about three percent to almost six percent. In the last three years, this rate has stayed close to five percent. (The complete range of values is given in Appendix 3.)

The analysis was repeated for each of these rates and the resulting per account values was tabulated in a histogram shown above. The histogram has two ranges of high frequency: one at $0.11 to $0.12 and the other at $0.19 to $.20. These values can be taken as the likely range of potential per account earnings on idle EBT balances.

Limitations of the Data

Because these data are summary items aggregated over all accounts, much useful detail indicative of individual behavior patterns under a regime of EBT delivery is lost. Such details provoke questions that are tantalizing in their reach beyond what may here be validly inferred. For example, although it is obvious from the graph of the flow of funds that not all accounts are exhausted by the end of the month, there is no way to identify from this information where those balances are. Is the undrawn amount uniformly distributed over all accounts? Are there differences in average undrawn balance attributable to the benefit program (or its population) that generates the account's funds. This seems likely when one program is a subsistence income program and another is a pension payment. The former is based upon need, the latter upon previous earnings. To be needy implies that all available funds barely cover necessities. The condition of long standing employment may have endowed the recipient with other assets which reduce the immediate need to consume all current receipts.

Equally possible is the potential difference between mature and new accounts, that is, a learning effect among recipients. New account holders who are unaccustomed to working with bank accounts may continue to operate from a cash horde by drawing all funds out as quickly as possible. Experience with the system may induce a more gradual draw down of account balances. A mature EBT delivery system might be characterized by far longer mean time to exhaustion of account funds and larger average undrawn balances. To the extent that there is turnover among the Texas DPC population, the test may not be representative of what can be expected in a more established EBT environment.

The information needed to answer these types of questions could be derived from analyzing a sample survey of recipients. Sample data that tracked the history and account activities of individual recipients under the various programs would be analyzed statistically using methods derived for life models or mean time to failure models. The statistics would compare draw down patterns for shifts in the mean time to account exhaustion attributable to program population (a cross-sectional approach) or for individual accounts over time (a longitudinal study.) Such data is not available at this time, but may be included in future analyses.

Target Idle Balance Amounts

The analysis can be inverted to study the undrawn balance as a target quantity to be achieved. Choice of this target might assist in identifying other means of compensating financial institutions for the costs of an EBT system. To calculate the size of monthly average idle balances per account,

$$\frac{N}{12}$$

can be solved for
yields the relation

$$\frac{21{,}700 \;\; 12}{(0.05)}$$

Choosing, for example, a per account monthly earnings of $2.00 would require an average monthly undrawn balance of $10,416,000 in the pilot or a per account average idle balance of $480.

Compare this amount with the average give in Appendix 2. For the three months under observation, the average balance attributable to funds paid in that period is $999,412. The actual amount achieved is 9.6% of value
legacy balance attributable to funds paid previously that may have been present during the study period the current balances actual may be higher than this 10% of target value.

Appendix 1: Gross Activity and Balance Data

The table below presents the data used in estimating earnings from idle EBT balances in the Texas Direct Payment Card test program. The data items are:

Column	Item
1	Month (Date). The data were collected in September, October, and November.
2	Day of Month (Date)
3	Business day and observation number. Because the ACH and banking system do not transfer funds between accounts on weekends and holidays, not all days on the calendar will see activity. This number is used to identify days when transaction might occur.
4	Total deposits. These are funds deposited under all support or benefit programs in the test. The two principal programs are the Supplemental Social Income (SSI) and Social Security Administration (SSA) payments made on the first and third days of the month. Other, smaller amounts are deposited throughout the month.
5	Withdrawals made through the Pulse network.
6	Withdrawals made through the Cirrus network.
7	Total withdrawals, the sum of columns 5 and 6.
8	Balance of EBT funds in all accounts, the net of column 4 plus the previous day's balance in column 8 less the amount in column 7. Note that the absence of ACH activity on weekends and holidays leaves balances unchanged for at least two days in every week.

Mo.	Day	Bus. Day	Total Deposits	W/D - Pulse	W/D - Cirrus	Total Withdrawn	Balance Brought Forward
8	30	1	$8,459,189.29	$3,313,202.60	$1,414,444.81	$4,727,647.41	$3,731,541.88
8	31		$0.00			$0.00	$3,731,541.88
9	1		$0.00			$0.00	$3,731,541.88
9	2		$0.00			$0.00	$3,731,541.88
9	3	2	$0.00	$944,064.98	$520,974.70	$1,465,039.68	$2,266,502.20
9	4	3	$55,254.04	$480,341.80	$200,242.55	$680,584.35	$1,641,171.89
9	5	4	$54,352.91	$224,699.12	$115,486.42	$340,185.54	$1,355,339.26
9	6	5	$50,890.71	$324,743.82	$162,252.76	$486,996.58	$919,233.39
9	7		$0.00			$0.00	$919,233.39
9	8		$0.00			$0.00	$919,233.39
9	9	6	$0.00	$67,819.46	$39,769.74	$107,589.20	$811,644.19
9	10	7	$15,215.04	$66,212.64	$38,039.21	$104,251.85	$722,607.38
9	11	8	$8,730.38	$49,785.28	$32,907.36	$82,692.64	$648,645.12
9	12	9	$1,028.80	$44,998.88	$20,690.84	$65,689.72	$583,984.20
9	13	10	$19,370.59	$88,149.03	$35,980.48	$124,129.51	$479,225.28
9	14		$0.00			$0.00	$479,225.28
9	15		$0.00			$0.00	$479,225.28
9	16	11	$12.16	$23,536.81	$16,746.73	$40,283.54	$438,953.90
9	17	12	$8,023.68	$22,924.37	$19,791.94	$42,716.31	$404,261.27
9	18	13	$8,978.59	$19,751.22	$17,262.91	$37,014.13	$376,225.73
9	19	14	$1,793.36	$20,807.85	$12,866.06	$33,673.91	$344,345.18
9	20	15	$75,862.18	$82,502.73	$29,249.15	$111,751.88	$308,455.48
9	21		$0.00			$0.00	$308,455.48
9	22		$0.00			$0.00	$308,455.48
9	23	16	$0.00	$11,144.84	$12,794.15	$23,938.99	$284,516.49
9	24	17	$11,731.02	$14,583.22	$11,967.32	$26,550.54	$269,696.97
9	25	18	$23,984.00	$13,468.65	$9,301.33	$22,769.98	$270,910.99
9	26	19	$285.00	$14,078.50	$7,950.54	$22,029.04	$249,166.95
9	27	20	$5,465.00	$40,220.06	$14,405.47	$54,625.53	$200,006.42
9	28		$0.00			$0.00	$200,006.42
9	29		$0.00			$0.00	$200,006.42
9	30	21	$0.00	$10,322.16	$12,329.71	$22,651.87	$177,354.55
10	1	22	$4,189,079.77	$1,793,372.52	$786,458.17	$2,579,830.69	$1,786,603.63
10	2	23	$31,583.42	$506,892.43	$140,047.03	$646,939.46	$1,171,247.59
10	3	24	$4,514,977.58	$1,823,476.28	$939,959.70	$2,763,435.98	$2,922,789.19
10	4	25	$55,888.04	$1,080,788.33	$409,160.85	$1,489,949.18	$1,488,728.05
10	5		$0.00			$0.00	$1,488,728.05
10	6		$0.00			$0.00	$1,488,728.05
10	7	26	$0.00	$130,315.67	$88,372.68	$218,688.35	$1,270,039.70

10	8	27	$20,180.87	$113,168.03	$60,188.73	$173,356.76	$1,116,863.81
10	9	28	$53.00	$82,303.59	$41,625.22	$123,928.81	$992,988.00
10	10	29	$6,143.97	$63,041.28	$34,264.67	$97,305.95	$901,826.02
10	11	30	$42,414.55	$166,269.28	$79,800.55	$246,069.83	$698,170.74
10	12		$0.00			$0.00	$698,170.74
10	13		$0.00			$0.00	$698,170.74
10	14		$0.00			$0.00	$698,170.74
10	15	31	$0.00	$30,371.71	$16,164.86	$46,536.57	$651,634.17
10	16	32	$29,673.76	$28,590.90	$22,041.53	$50,632.43	$630,675.50
10	17	33	$9,771.70	$26,168.83	$14,990.03	$41,158.86	$599,288.34
10	18	34	$61,201.75	$85,867.04	$33,084.25	$118,951.29	$541,538.80
10	19		$0.00			$0.00	$541,538.80
10	20		$0.00			$0.00	$541,538.80
10	21	35	$0.00	$14,733.63	$12,511.77	$27,245.40	$514,293.40
10	22	36	$22,657.87	$17,617.06	$13,812.01	$31,429.07	$505,522.20
10	23	37	$817.48	$19,254.45	$11,226.82	$30,481.27	$475,858.41
10	24	38	$55,119.05	$17,977.10	$8,471.57	$26,448.67	$504,528.79
10	25	39	$1,203.00	$41,547.39	$24,156.52	$65,703.91	$440,027.88
10	26		$0.00			$0.00	$440,027.88
10	27		$0.00			$0.00	$440,027.88
10	28	40	$0.00	$9,734.71	$7,719.18	$17,453.89	$422,573.99
10	29	41	$5,076.86	$12,967.11	$9,267.43	$22,234.54	$405,416.31
10	30	42	$5,883.00	$13,794.80	$8,027.07	$21,821.87	$389,477.44
10	31	43	$506.00	$12,752.64	$7,841.76	$20,594.40	$369,389.04
11	1	44	$8,860,959.28	$4,452,757.09	$1,853,228.80	$6,305,985.89	$2,924,362.43
11	2		$0.00			$0.00	$2,924,362.43
11	3		$0.00			$0.00	$2,924,362.43
11	4	45	$0.00	$450,222.46	$280,065.57	$730,288.03	$2,194,074.40
11	5	46	$98,036.45	$285,911.10	$149,617.88	$435,528.98	$1,856,581.87
11	6	47	$15,458.80	$169,511.73	$70,886.67	$240,398.40	$1,631,642.27
11	7	48	$5,501.10	$108,132.97	$77,548.10	$185,681.07	$1,451,462.30
11	8	49	$30,061.53	$256,115.78	$129,154.53	$385,270.31	$1,096,253.52
11	9		$0.00			$0.00	$1,096,253.52
11	10		$0.00			$0.00	$1,096,253.52
11	11		$0.00			$0.00	$1,096,253.52
11	12	50	$0.00	$50,810.54	$30,934.68	$81,745.22	$1,014,508.30
11	13	51	$6,624.79	$36,106.80	$27,622.95	$63,729.75	$957,403.34
11	14	52	$9,256.67	$38,152.11	$19,600.31	$57,752.42	$908,907.59
11	15	53	$56,821.14	$103,636.68	$37,577.12	$141,213.80	$824,514.93
11	16		$0.00			$0.00	$824,514.93
11	17		$0.00			$0.00	$824,514.93
11	18	54	$0.00	$19,419.70	$14,567.61	$33,987.31	$790,527.62

11	19	55	$9,751.08	$39,701.66	$18,192.62	$57,894.28	$742,384.42
11	20	56	$13,046.15	$22,475.90	$16,755.92	$39,231.82	$716,198.75
11	21	57	$5,915.11	$38,493.61	$12,299.30	$50,792.91	$671,320.95
11	22	58	$19,893.90	$55,457.45	$15,039.41	$70,496.86	$620,717.99
11	23		$0.00			$0.00	$620,717.99
11	24		$0.00			$0.00	$620,717.99
11	25	59	$0.00	$16,505.85	$8,222.41	$24,728.26	$595,989.73
11	26	60	$25,677.78	$15,203.14	$10,446.21	$25,649.35	$596,018.16

Appendix 2: Float Earnings Calculations

In the following table, the balance given for the corresponding data is used to calculate the interest value of the idle balances across all DPC accounts. The specific data elements are:

Column	Item
1	Business day and observation number. This corresponds to the observations listed in column 3 in the table in Appendix 1.
2	Balance summed across all Direct Payment Card accounts. This is taken from column 4 in the table in Appendix 1.
3	Imputed interest earned on the balance in column 2 in one day at five percent.
4	Daily interest earnings per account. This is calculated as the result from column 3 divided by the average number of active accounts, 21,700.

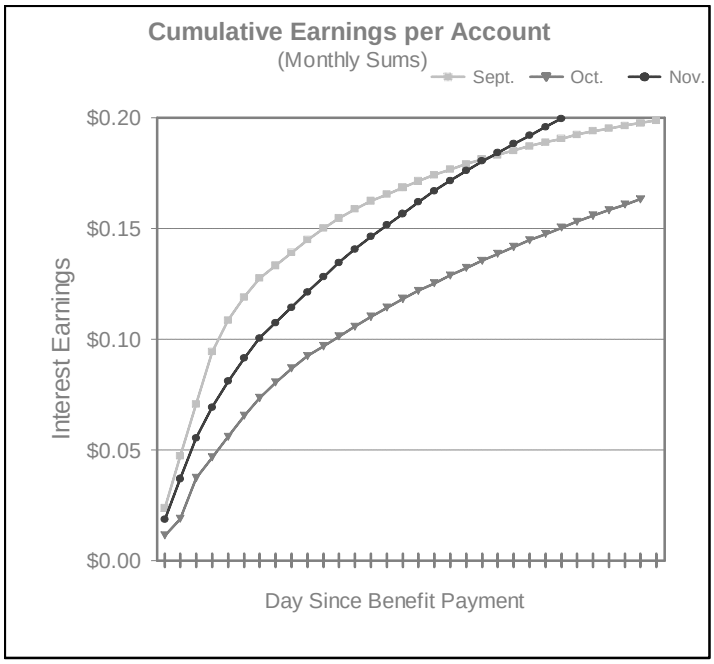
Business Day	Balance Brought Forward	Financial Institution Earnings @ 5%	Earnings per Account
1	$3,731,541.88	$511.17	$0.02
	$3,731,541.88	$511.17	$0.02
	$3,731,541.88	$511.17	$0.02
	$3,731,541.88	$511.17	$0.02
2	$2,266,502.20	$310.48	$0.01
3	$1,641,171.89	$224.82	$0.01
4	$1,355,339.26	$185.66	$0.01
5	$919,233.39	$125.92	$0.01
	$919,233.39	$125.92	$0.01
	$919,233.39	$125.92	$0.01
6	$811,644.19	$111.18	$0.01
7	$722,607.38	$98.99	$0.00
8	$648,645.12	$88.86	$0.00
9	$583,984.20	$80.00	$0.00
10	$479,225.28	$65.65	$0.00
	$479,225.28	$65.65	$0.00
	$479,225.28	$65.65	$0.00
11	$438,953.90	$60.13	$0.00
12	$404,261.27	$55.38	$0.00

13	$376,225.73	$51.54	$0.00
14	$344,345.18	$47.17	$0.00
15	$308,455.48	$42.25	$0.00
	$308,455.48	$42.25	$0.00
	$308,455.48	$42.25	$0.00
16	$284,516.49	$38.97	$0.00
17	$269,696.97	$36.94	$0.00
18	$270,910.99	$37.11	$0.00
19	$249,166.95	$34.13	$0.00
20	$200,006.42	$27.40	$0.00
	$200,006.42	$27.40	$0.00
	$200,006.42	$27.40	$0.00
21	$177,354.55	$24.30	$0.00
22	$1,786,603.63	$244.74	$0.01
23	$1,171,247.59	$160.44	$0.01
24	$2,922,789.19	$400.38	$0.02
25	$1,488,728.05	$203.94	$0.01
	$1,488,728.05	$203.94	$0.01
	$1,488,728.05	$203.94	$0.01
26	$1,270,039.70	$173.98	$0.01
27	$1,116,863.81	$153.00	$0.01
28	$992,988.00	$136.03	$0.01
29	$901,826.02	$123.54	$0.01
30	$698,170.74	$95.64	$0.00
	$698,170.74	$95.64	$0.00
	$698,170.74	$95.64	$0.00
	$698,170.74	$95.64	$0.00
31	$651,634.17	$89.26	$0.00
32	$630,675.50	$86.39	$0.00
33	$599,288.34	$82.09	$0.00
34	$541,538.80	$74.18	$0.00
	$541,538.80	$74.18	$0.00
	$541,538.80	$74.18	$0.00
35	$514,293.40	$70.45	$0.00
36	$505,522.20	$69.25	$0.00
37	$475,858.41	$65.19	$0.00
38	$504,528.79	$69.11	$0.00
39	$440,027.88	$60.28	$0.00
	$440,027.88	$60.28	$0.00
	$440,027.88	$60.28	$0.00
40	$422,573.99	$57.89	$0.00
41	$405,416.31	$55.54	$0.00

42	$389,477.44	$53.35	$0.00
43	$369,389.04	$50.60	$0.00
44	$2,924,362.43	$400.60	$0.02
	$2,924,362.43	$400.60	$0.02
	$2,924,362.43	$400.60	$0.02
45	$2,194,074.40	$300.56	$0.01
46	$1,856,581.87	$254.33	$0.01
47	$1,631,642.27	$223.51	$0.01
48	$1,451,462.30	$198.83	$0.01
49	$1,096,253.52	$150.17	$0.01
	$1,096,253.52	$150.17	$0.01
	$1,096,253.52	$150.17	$0.01
	$1,096,253.52	$150.17	$0.01
50	$1,014,508.30	$138.97	$0.01
51	$957,403.34	$131.15	$0.01
52	$908,907.59	$124.51	$0.01
53	$824,514.93	$112.95	$0.01
	$824,514.93	$112.95	$0.01
	$824,514.93	$112.95	$0.01
54	$790,527.62	$108.29	$0.00
55	$742,384.42	$101.70	$0.00
56	$716,198.75	$98.11	$0.00
57	$671,320.95	$91.96	$0.00
58	$620,717.99	$85.03	$0.00
	$620,717.99	$85.03	$0.00
	$620,717.99	$85.03	$0.00
59	$595,989.73	$81.64	$0.00
60	$596,018.16	$81.65	$0.00
Total	$88,947,658.01	$12,184.61	$0.56
Monthly Average	$999,411.89	$4,164.22	$0.19

The monthly average is obtained by re-scaling the amounts given in the totals which were calculated over a ninety day period. The totals in columns 3 and 4 were divided by 90 and then multiplied by (365 / 12).

The values given in column 4 can also be aggregated through the month to show how the funds are accumulated. The pattern is shown in the following graph. Each month (September, October, and November) is given as a separate curve. There are similarities among the curves which reflect the pattern of the balances. In particular, the larger relative balances of the beginning of each month lead to quick accumulation of earnings. In two cases, half of the month's interest earnings are achieved within the first week. In the third case, a second week is needed. After that point, the accumulation slows down as the balances on which they are based dwindles. The third case, however, was also the more likely case of SSA and SSI deposits on separate days with no weekend or major holiday intervening between the deposit and start-of-the-month withdrawals. It is also the month in which imputed interest earnings are lowest. This difference between the patterns suggests the desirability of extending the data series for additional months.



Appendix 3: Interest Rate Selection

The following table presents the range of monthly averages of the thirteen week Treasury bill rate since 1991. The calculation performed with the balances given in the table in Appendix 2 was redone with each of the rates given here.

Earnings Credit Rate, 1991-1997
(13 Week T-Bill Rate - Monthly Average)

	1991	1992	1993	1994	1995	1996	1997
Jan		3.94	3.13	3.08	5.98	5.17	5.19
Feb		3.95	3.01	3.28	5.97	5.01	5.13
Mar		3.95	3.04	3.60	5.91	5.09	5.28
Apr		3.90	2.95	3.83	5.85	5.12	5.31
May		3.75	3.02	4.30	5.88	5.16	5.27
Jun		3.79	3.17	4.29	5.67	5.25	
Jul		3.35	3.12	4.50	5.64	5.31	
Aug		3.21	3.12	4.61	5.58	5.23	
Sep	5.41	3.03	3.02	4.76	5.42	5.29	
Oct	5.18	2.90	3.10	5.09	5.46	5.14	
Nov	4.73	3.21	3.19	5.40	5.51	5.17	
Dec	4.24	3.32	3.15	5.80	5.32	5.00	